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Soil Tests for Fertilizer Recommendations

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A "rapid soil test" or a "quick soil test" is a chemical method for determining the nutrient-supplying power of a soil. Reliable fertilizer recommendations may be developed by correlating laboratory soil-test values with crop responses from fertilizer-rate experiments conducted in the field for several years with a particular crop growing on a soil type.

The U.S. Department of Agriculture has no facilities for making rapid soil tests for individuals. However, such tests are made routinely by State-supervised laboratories located at the college, county offices, or State Department of Agriculture. Although most States charge for testing soils, the fee is small in comparison to the service received. California and Illinois do not provide this service, but it is available through commercial laboratories. In addition, as a service to their customers, some agricultural companies make rapid soil tests.

The soil mineral nutrients needed to support plant growth are in various states of solubility. They may range from completely water soluble to completely insoluble so that they are not available during the growing season. Also, plant roots vary in their capacity to explore the soil and in their so-called feeding power. The problem faced by the soil chemist is to select a method of rapidly assessing the nutrient availability to a specific plant root system. Many methods of extracting and measuring the nutrients from a soil sample so as to predict the quantities available to the growing plant during its growing season have been tried. One of the first quick soil tests for assaying soil fertility was developed by Daubery[1/] in England in 1845.

In practice, the choice of soil test methods for use by a particular laboratory is based on extensive tests of different methods of extracting a part of the total amount of nutrient in the soil. The reagent chosen is the one that shows the best correlation between the amount extracted and the availability of the soil nutrient to the crops as determined in field tests.

1/ Daubery, C. G. B. Roy. Soc. (London) Phil. Trans. 135:179-253. 1845.

A different reagent may be used for each of the different plant nutrients. For example, potassium is usually extracted with a salt solution but phosphorous may be extracted with a dilute acid or an alkaline solution.

Any suitable, convenient method of analyzing the soil extract for the element in question may be used. For example, potassium may be determined chemically, with a flame photometer, or spectrographically. Flame photometry is usually used because it is faster.

Regardless of the testing method used, reliable soil tests are valuable guides to lime and fertilizer recommendations only when (1) the sample tested is representative of the soil in the field, and (2) in addition to the test results other factors that influence nutrient availability--such as soil temperature, aeration, and moisture content, and the soil's ability to replenish the nutrients removed by plants--and the plants' nutrient requirements are considered.

Those wishing to have soil tested are advised to contact their local county agricultural agent before soil samples are selected. In some instances, the soil tests are made at the county office. Where this is not done, the director of the central soil-testing laboratory usually prefers that the samples be sent through the agent. Directions for sampling, sample containers, and forms to fill out regarding soil-use history and crops to be grown are available from the agent.

Do not send samples for soil testing to the U.S. Department of Agriculture.

One problem the soil-testing laboratories face results from too many samples arriving in the spring. Samples taken in the fall may predict growing conditions better than those taken the following spring. Also, there is more time for considering the recommendations provided, making plans, and obtaining supplies.

The farmer considers the resources available to him before purchasing fertilizer needs. If funds are limited, he may be justified in purchasing only part of the fertilizer recommended for expected optimum crop yields per acre and purchasing other inputs, for example, pesticides.

For those who wish to experiment with rapid soil tests, portable kits are available. The kits range from simple kits for soil acidity to complete kits for determining a dozen or so nutrients. A partial list of addresses of companies making such kits follows:

R. P. Cargille Laboratories, Inc.
35 Village Park
Cedar Grove, New Jersey 07009

The Edwards Laboratory
202 Milan Avenue
Norwald, Ohio 44857

Hellige, Inc.
877 Stewart Avenue
Garden City, New Jersey 07009

Industrial Instruments, Inc.
95 Commerce Road
Cedar Grove, New Jersey 07009

La Motte Chemical Products Co.
Chestertown, Maryland 21620

Soiltest Inc., Subsidiary Cinco Instruments Corp.
2205 Lee Street
Evanston, Illinois 60202

Sudbury Laboratory
Sudbury, Massachusetts 01776

W. A. Taylor & Co.
7308 York Road
Baltimore, Maryland 21204

Technical Products Co.
873 Vance Avenue
Memphis, Tennessee 38126

Testlab Corporation
218 No. Clinton
Chicago, Illinois 60606

Several scientific supply houses also distribute soil test kits.

*****It is impractical to provide a complete list of manufacturers and dealers, but this partial list is furnished to provide specific information. Mention of a firm does not constitute a guarantee or warranty of the firm's products by the U.S. Department of Agriculture or an endorsement by the Department over the products of other firms not mentioned.*****

For those who wish to set up relatively simple laboratory equipment for making soil tests, the following references are suggested:

Spurway, C. K. Soil Testing--A Practical System of Soil Diagnosis. Mich. Agr. Expt. Sta. Tech. Bul. 132, 16 pp. 1933.

Connor, S. D., and Frazer, R. R. The Use of Rapid Chemical Tests on Soils and Plants as Aids in Determining Fertilizer Needs. Ind. Agr. Expt. Sta. Cir. 204, 16 pp. 1934.

Hester, J. B., Blume, J. M., and Shelton, Florence A. Truck Crop Investigations--Rapid Chemical Tests for Coastal Plain Soils. Va. Truck Expt. Sta. Bul. 95, 50 pp. 1937.

Baver, L. D., and Brumer, F. H. Rapid Soil Tests for Estimating the Fertility Needs of Missouri Soils. Mo. Agr. Expt. Sta. Bul. 404, 16 pp. 1939.

Merkle, F. G. Soil Testing-Operation, Interpretation, and Application. Pa. Agr. Expt. Sta. Bul. 398, 34 pp. 1940.

Morgan, M. P. Chemical Soil Diagnosis by the Universal Soil Testing System.
Conn. Agr. Expt. Sta. Bul. 450, 67 pp. 1941.
(Supplement issued Sept. 1945.)

Ohlrogge, A. J. The Purdue Soil and Plant Tissue Tests.
Ind. Agr. Expt. Sta. Bul. 635, 19 pp. 1956.

Page, N. R., Compiler. Procedures Used by State Soil-Testing Laboratories in the Southern Region of the United States.
South. Coop. Ser. Bul. (Experiment Ga.) 102, 42 pp. 1965.

Greweling, Thomas, and Peech, Michael. Chemical Soil Tests.
Cornell Agr. Expt. Sta. Bul. 960, 54 pp. 1960.

Further information on the use of rapid soil tests is given in the following reports:

Viets, F. G. Jr., and Hanway, J. J. How to Determine Nutrient Needs.
In Soil, U.S. Dept. Agr. Yearbook 1957:172-184.

American Chemistry Society, Division of Fertilizer and Soil Chemistry.
Symposium on Soil Testing.
Jour. Agr. Food. Chem. 8(2):84-104. 1960.

Hanway, J. J. An Objective Look at Soil Testing.
Crops and Soils, pp. 4 and 5, March 1965.

Rouse, R. D. Soil Testing--The Experiment Station View.
Crops and Soils, pp. 4 and 5, August-September 1965.

If these references are not available through your local library, photocopies may be purchased from the National Agricultural Library, Washington, D. C. 20250.